# Supplemental Downlink Helps Ease Spectrum Crunch

- Uses unpaired spectrum for faster downloads & to support more users
- Addresses epicenter of spectrum crunch– more downloads than uploads
- Being standardized for LTE in LTE-Advanced. Demo uses HSPA+.

Supplemental Downlink (Unpaired spectrum)

FDD Downlink (Paired)

FDD Uplink (Paired)

SDL

DL

UL

- QC unpaired Lower 700 MHz D and E spectrum would be bonded with AT&T paired spectrum on which AT&T has deployed LTE (not 700 MHz), if ATT-QC deal is approved.
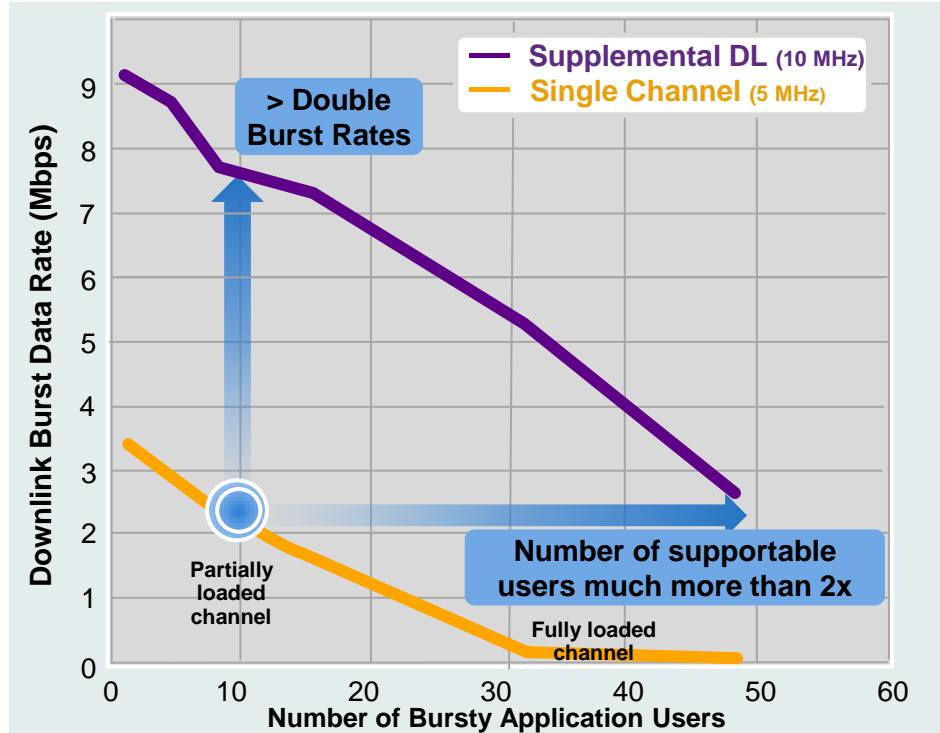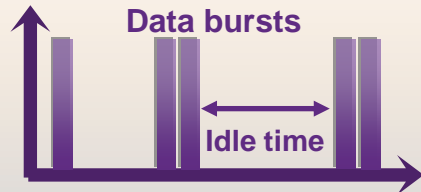- Demo uses 2 x 5 MHz of AWS-1 paired spectrum & 5 MHz of unpaired spectrum at 1.4 GHz.
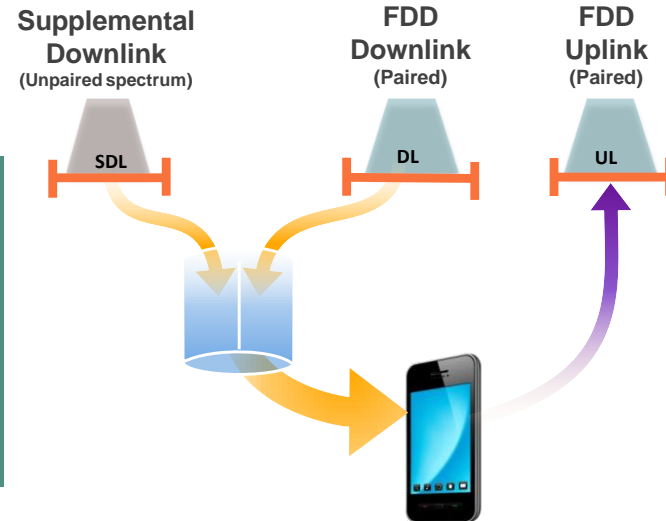
[1]Aggregation across bands already supported in 3GPP R9, but each additional band combination has to be defined in 3GPP.
[2]L-Band in Europe:1452 MHZ to 1492 MHz.

Supplemental Downlink Supports Faster Downloads, More Users & Enhances the User Experience

Bursty Data Applications

Data bursts

Idle time

Chart: Downlink Burst Data Rate (Mbps) vs Number of Bursty Application Users

- **Supplemental DL (10 MHz)**
- **Single Channel (5 MHz)**

> Double Burst Rates

Partially loaded channel

Fully loaded channel

Number of supportable users much more than 2x

Qualcomm simulations. 16 R99 users on anchor channel and varying data users on 5MHz single or on 10MHz SDL channel 1km ISD, PA3, Pilot Power = 10% Other Overhead Power = 20%. R99 user power consumption = 20%. Lower control overhead on the SDL carrier: 10%. The bursty nature means that a multicarrier can support more users at the same burst rate for partially loaded carriers. The gain depends on the load and can exceed 100% for fewer users (less loaded carrier) but less for many users (starting to resemble full buffer).

HSPA+ Supplemental Downlink Demo, With L-Band

AT&T Innovation Center Washington, DC

Display Computer

Real Time Display and Control of System Performance

Equipment Room, San Diego, US

Test UEs

Single Channel (SC) UE

MDM8220 Based UE

MDM8220 Based UE

Supplemental Downlink (SDL) UE

Test Channel

Channel Emulator

Cabled RF: Downlinks are L-Band and 2.1GHz

Test Radio / Core Network

Test Base Station

Test Base Station (for Geometry)

Iub

Test RNC & SGSN

Gn

Test GGSN

Gi

Control Computer

Content Server

SDL

SDL

SDL

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